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Animal Keepers' Forum

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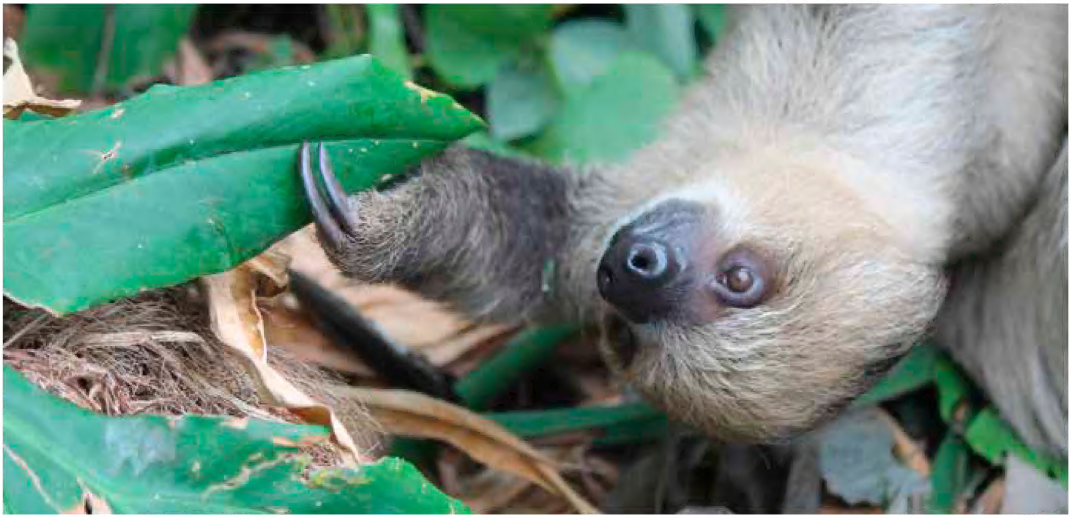

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AMERICAN ASSOCIATION of ZOO KEEPERS

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American Association of Zoo Keepers, Inc.

The American Association of Zoo Keepers, Inc. exists to advance excellence in the animal keeping profession, foster effective communication beneficial to animal care, support deserving conservation projects, and promote the preservation of our natural resources and animal life.

ABOUT THE COVER

This month's cover features Ivy, a two-toed sloth *(Choloepus didactylus)* and Fern, her 4-month-old offspring. *C. didactylus* is one of just two species of two-toed sloths. Offspring like Fern, will remain with their mother for an extended period (a minimum of 10 months but often stay much longer). During this time young sloths have been observed tasting food items directly from the mother's mouth and will sample nearby plants.

Two-toed sloths (*C. didactylus* and *C. hoffmani*) are listed as Least Concern (LC) by the International Union for Conservation (IUCN) but unfortunately some three-toed sloth populations have experienced significant decline. The Maned Three-toed Sloth *(Bradypus torquatus)* and the Pygmy Three-toed Sloth *(Bradypus pygmaeus)* are categorized as Vulnerable (VU) and Critically Endangered (CR).

Articles sent to *Animal Keepers' Forum* will be reviewed by the editorial staff for publication. Articles of a research or technical nature will be submitted to one or more of the zoo professionals who serve as referees for *AKF*. No commitment is made to the author, but an effort will be made to publish articles as soon as possible. Lengthy articles may be separated into monthly installments at the discretion of the Editor. The Editor reserves the right to edit material without consultation unless approval is requested in writing by the author. Materials submitted will not be returned unless accompanied by a stamped, self-addressed, appropriately-sized envelope. Telephone, fax or e-mail contributions of late-breaking news or last-minute insertions are accepted as space allows. Phone (330) 483-1104; FAX (330) 483-1444; e-mail is shane.good@aazk.org. If you have questions about submission guidelines, please contact the Editor. Submission guidelines are also found at: aazk.org/akf-submission-guidelines/.

Deadline for each regular issue is the 3rd of the preceding month. Dedicated issues may have separate deadline dates and will be noted by the Editor.

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FROM THE PRESIDENT

I hope you will consider how you can make a difference in the future of our Association by contributing to an AAZK Committee or Program.

Every two years, the AAZK CEO/CFO executes a call for nominations for members to fill expiring positions on the AAZK Board of Directors. When I joined the AAZK Board of Directors in 2015, there were three open positions and a total of nine nominations. Approximately 10% of the AAZK membership participated in the election process through electronic voting. This was the highest percentage of member participation for an AAZK electronic election and even exceeded the percentage of votes returned in the previous paper election process.

In 2017, the Board made the decision to expand from five members to seven members. That meant there were four open positions when the call for nominations went out. We received a total of four nominations. AAZK policy states that unless contrary direction is given by the seated Board, an election is not required. For the first time ever, the membership did not have to participate in an election.

This year, three positions were announced and only two nominations were received. Once again, an election was not warranted. By unanimous vote of the seated members of AAZK Board of Directors, I am happy to announce that Jim Weinpress and Kristen Scaglione will be officially sworn in at the conclusion of the AAZK National Conference this August in Indianapolis. Please watch for more introductions to Jim and Kristen when their bios appear in the July issue of the *Animal Keeper's Forum.*

Both Jim and Kristen are part of what I consider the AAZK leadership team, as they are currently serving as the Chair of the Communication Committee and the Manager of the NZKW Program respectively. When they join the Board of Directors, there will be opportunity for new AAZK members to fill these leadership roles. I hope you will consider how you can make a difference in the future of our Association by contributing to an AAZK Committee or Program.

I can't help but feel disappointed in the decline of nominations for the AAZK Board of Directors. Serving the AAZK membership as part of the Board has been incredibly rewarding for me, both personally and professionally. It has made me a better listener, a more effective communicator and a stronger leader.

I encourage each of you to reach out with your questions or concerns. On behalf of the Board, we are always available. I look forward to hearing from you.

Warm regards,

Bethany

Bethany
Bethany.bingham@aazk.org

COMING EVENTS

Post upcoming events here!
e-mail shane.good@aazk.org

July 13-19, 2019
Felid TAG:
Husbandry Courses - July 13-15
SSP Meetings - July 15-16
TAG Meetings - July 17-19
Omaha, NE
Hosted by Omaha's Henry Doorly Zoo and Aquarium
More information coming soon!

July 22-26, 2019
Prosimian TAG Husbandry Workshop and Mid-year Meeting
Dallas, TX
Hosted by the Dallas Zoo
Three day workshop followed by TAG meetings
For more information contact:
PTAG2019@dallaszoo.com

August 4-8, 2019
17th Annual Symposium on the Conservation and Biology of Tortoises and Freshwater Turtles - Tucson, AZ
Hosted by the Turtle Survival Alliance and the IUCN Tortoise and Freshwater Turtle Specialist Group. For more information go to: https://turtlesurvival.org/2019symposium/

August 26-28, 2019
Orangutan SSP Husbandry Workshop
Fort Wayne, IN
Hosted by the Fort Wayne Children's Zoo
For more information go to:
http://www.orangutanssp.org/2019-workshop.html

September 7-11, 2019
AZA Annual Conference
New Orleans, LA
Hosted by Audubon Zoo and Audubon Aquarium of the Americas
For more information go to:
aza.org

September 22-27, 2019
ASSOCIATION OF ZOO VETERINARY TECHNICIANS Annual Conference
Colorado Springs, CO
Hosted by Cheyenne Mountain Zoo
For more information go to:
https://www.azvt.org/page-7741

September 30 - Oct. 4, 2019
New World Primate TAG Husbandry Workshop
New Bedford, MA
Hosted by Buttonwood Park Zoo
For more information go to:
https://www.bpzoo.org/nwptag-conference-registration/

October 7-11, 2019
Giraffe Care Workshop
Colorado Springs, CO
Hosted by Cheyenne Mountain Zoo
For more information go to:
http://www.cmzoo.org/index.php/giraffe-care-workshop/

October 7-11, 2019
"From Good Care to Great Welfare" workshop
Detroit, MI
Hosted by Detroit Zoological Society's Center for Zoo and Aquarium Animal Welfare and Ethics. For more information go to: http://www.czaw.org/events

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August 18-22, 2019
AAZK National Conference
Indianapolis, IN

Hosted by Indy AAZK and the Indianapolis Zoo

www.indyaazk.org

April 4-9, 2020
AZA Mid-Year Meeting
Palm Springs, CA
Hosted by The Living Desert Zoo and Gardens. For more information go to:https://midyear.aza.org/

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Dietary Survey of Captive Southern White Rhinoceros Populations (*Ceratotherium simum simum*)

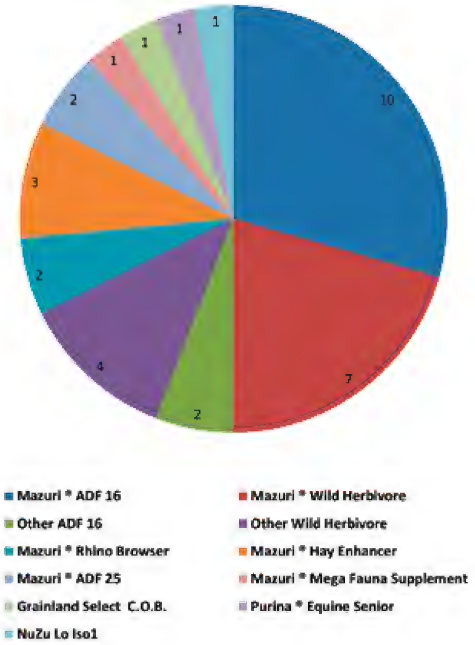
Daniel Soler, Lead Rhino Keeper
Lion Country Safari
Loxahatchee, Florida

For reasons that are not completely understood, rates of reproduction in captive-born southern white rhinoceros *(Ceratotherium simum simum)* females are surprisingly low, whereas the number of calves born to wild-caught rhinos has proven to be more predictable and prolific. Due to the low breeding success of captive-born females, nearly every mature female is currently recommended to breed by the southern white rhino [SWR] Species Survival Plan [SSP] advisory group. If reproduction were more reliable, then selective breeding to maintain gene diversity would be more probable.

While there may be several factors contributing to this lack of reproductive success in captive-borns, diet and nutrition should be carefully considered. As the domestic horse shares similar digestive physiology to the SWR, it currently serves as the best model for SWR diets [Metrione & Eyres, 2015; Dierenfeld, 1999]. However, research has shown that perhaps certain fat-soluble vitamins are not absorbed equally by both taxa [Clauss, 2002]. Furthermore, recent research has indicated that perhaps phytoestrogens present in the rhino diet are having a negative impact on breeding success in the species [Tubbs, 2016].

It may prove difficult for many zoos to provide the sheer volume of pasture that southern white rhinos require. Because of this, *ad libitum* grass hay is offered to rhinos as the primary portion of diet in almost all cases. Concentrated pellets are also often

Figure 1. Number of facilities feeding pellet type



offered as a supplement, as is recommended by the best-practice dietary guidelines for SWRs [Metrione & Eyres, 2015]. However, quantity suggestions are nebulous and dependent upon individual pellet formulations [Metrione & Eyres, 2015].

We seek to investigate the nutritional content of an appropriate southern white rhino diet. In service of this goal, we conducted a survey of current feeding regimes across facilities housing these rhinos. We hope to uncover what rhino-specific pellets should consist of, and how much—if any—should be offered in the daily diet. The first step in achieving this is to determine how captive rhinos are currently fed, which is what we present here. Future research should also investigate how that relates to reproduction and overall health.

Methods & Results

There are currently 46 institutions accredited by the Association of Zoos and Aquariums [AZA] and four private institutions contributing to the southern white rhino SSP. We composed a survey that formally inquiries about feeding routines and related management procedures at these facilities—such as weight management and blood screenings. We then compared the collected data using Microsoft Excel, and investigated patterns using descriptive statistics.

Of the 50 surveyed facilities, there have been 32 responses to date. As a result of imprecise dietary plans, we see a great deal of variation among institutions, which may contribute to the breeding and health limitations set on females in captivity.

The brands and types of pellets fed across those surveyed differed radically. Eight different types of pellets were used across at least five different brands. Wild Herbivore and ADF 16 are the dominant feed types, making up 33% (ten Mazuri®; four “other” brands) and 36% (seven Mazuri®; two “other” brands) of diets respectively. (See Figure 1).

The amount of pellets also vastly differs among institutions, with daily feed amounts weighing between zero and 12.7 kgs (See Figure 2). This is perhaps due to the independent formulation of the pellets that are fed out [Metrione and Eyres, 2015], or the perceived notion that smaller exhibits necessitate larger supplementation.

It is important to recognize that 24 facilities among 32 responders have less than three acres of available rhino pasture. In fact, 18 responded as having no pasture at all. In situations like these, it is no wonder that a supplemented diet is necessary (See Figure 3). While some facilities with large pasture and open spaces may not need to utilize pellets as part of SWR diets, many facilities do not have access to such exhibits.

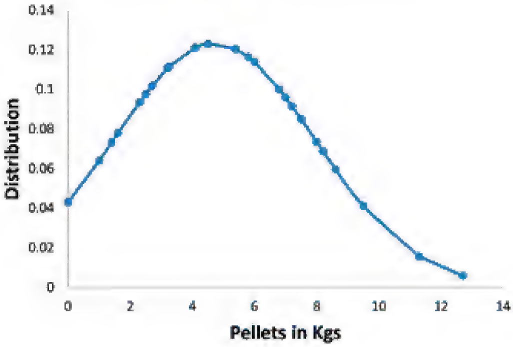
Also, despite research highlighting the negative effects of alfalfa on overall health [Tubbs et al., 2016], over 65% of these facilities still feed out some degree of alfalfa. However, exact quantities of alfalfa were not specified by all facilities, and research indicates excess alfalfa use hinders overall health, but if used in moderation effects are negligible [Clauss & Hatt, 2006; Tubbs et al., 2016; Tubbs, Personal Comm, 2017].

Points of Interest and Lessons Learned

The typical diet of a southern white rhino is generally described as having a high fiber and low to moderate protein content [Clauss & Hatt, 2006]. Whether offering a strictly hay diet can meet these basic requirements is unknown and likely depends upon exhibit and pasture size. However, the question remains: should pellet concentrations focus on the fiber-protein content, the vitamin-mineral content, or all of the above?

Further, hay quality should be routinely tested and reported to SSP advisory committees in order to establish a better understanding of possible nutritional deficiencies. If necessary

Figure 2. Distribution of amount of pellets fed



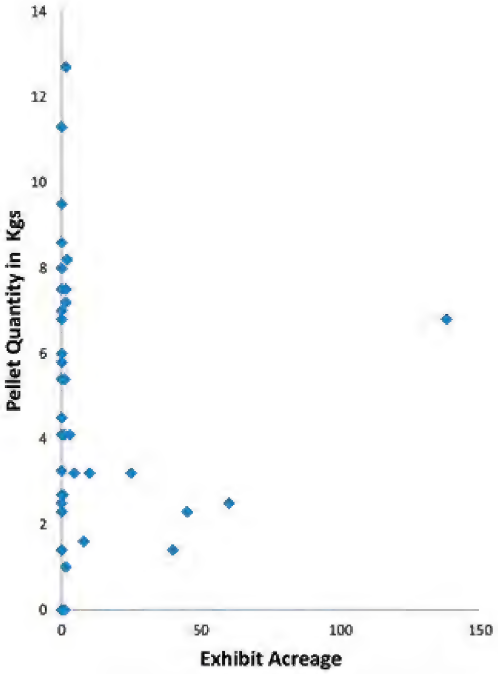


Figure 3. Correlating pasture size and pellet quantity

and/or possible, facilities in relatively close proximity should work together to establish a "best methods" protocol for hay acquisition. "The logical solution to the dilemma of limited availability of forage is to either contract farmers or cultivate land owned by the zoo. Potentially several zoos could collaborate to contract a farmer if it is more economical to purchase a high tonnage. Such cooperation should be a long-term commitment with a mutual learning process that would eventually result in the production of forage of the highest quality [Clauss & Hatt, 2006]."

Thus far, only four of 32 facilities have reported deficiencies observed from blood analyses. However, it is unknown what percentage of surveyed facilities regularly engages in blood screens, as we neglected to ask this important question. Further, we cannot discern what screening assays are utilized at those facilities that do engage in the practice. Future research should include more specific questions about institutional blood analysis protocols and procedures.

Considering recent research [Tubbs et al, 2016], the number of facilities that continue to feed alfalfa to their SWR population was unexpected. However, it is imperative to recall that this survey did not specifically inquire about quantities of alfalfa fed; therefore, it is possible that the alfalfa offered is in very small amounts and therefore not overall detrimental to the animals' health. This possibility is well-demonstrated by our own practices: Lion Country Safari regularly offers our southern white rhinos alfalfa in very small increments as a training incentive or in situations that involve the media. Additionally, it is possible that the recent finding of alfalfa-related health detriments to SWRs may not have reached a widespread audience yet. Consideration should therefore be given to these data at future conferences and workshops.

While current recommendations for southern white rhino diet are modeled after recommendations for the domestic horse, SWR diet formulation must progress to the development of rhino-specific recommendations. In order for this to be accomplished, a better understanding of natural, balanced SWR diets is needed. Further research and experimentation is necessary in order to create a sufficiently nutritious pellet concentrate.

While it may not be possible to fully standardize diet procedure—due to individual facility circumstances—it could be feasible to reduce the amount of inconsistency across institutions and attain a more sustainable reproductive outcome in our captive southern white rhino SSP population. Given the lack of diet consistency currently found among facilities, it is apparent that further research is needed and steps should be taken to develop a cohesive, balanced dietary plan for the southern white rhino.

Acknowledgments

I want to express my thanks to Lion Country Safari for allowing me to conduct this project as well as to the other facilities that participated; ABQ Biopark Zoo, Audubon Zoo, Birmingham Zoo, Brevard Zoo, Busch Gardens, Cameron Park Zoo, Detroit Zoo, Disney's Animal Kingdom, Fossil Rim, Fresno Zoo, Glen Oak, Granby Zoo, Henry Doorly Zoo, Utah's Hogle Zoo, Houston Zoo, Indianapolis Zoo, Jacksonville Zoo, Knoxville Zoo, Maryland Zoo, Memphis Zoo, North Carolina Zoo, Philadelphia Zoo, Rolling Hills, Safari West, San Antonio Zoo, San Diego Wild Animal Park, Seneca Park Zoo, The Wilds, Tulsa Zoo, Virginia Zoo, and White Oak. I would also like to acknowledge Adam Eyres for his help in facilitating responses from said facilities. Gratitude is extended to Ashleigh Kandrac and Dr. Elizabeth Hammond for helping to create the survey used in this study. Finally, a special thanks to Tina Cloutier Barbour for her assistance and guidance in completing this study.

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Two-toed Sloths (*Choloepus didactylus*): Ten Years of Husbandry and Management at the National Aquarium

Debra Dial, Assistant Curator of Australia & Rain Forest Exhibits
National Aquarium
Baltimore, Maryland

The National Aquarium houses two-toed sloths (*Choloepus didactylus*) in the Upland Tropical Rain Forest. A husbandry retrospective is possible with 10 years of detailed observations. This review is unique for the number of sloths (5.5) discussed and for their habitat, which provides the animals with many opportunities for choice.

Upland Tropical Rain Forest Exhibit

The large, walk-through exhibit is densely planted and has multiple water features within a glass pyramid. The exhibit has mature trees, a varied botanical collection and is home to a variety of taxa including birds, reptiles, amphibians and fish. The Aquarium's sloths have free-access to the approximately 557 m^2 (6,000 ft^2) space. Sloths traverse the exhibit by climbing on trees which include cacao (*Theobroma cacao*), cecropia (*Cecropia peltata*), and ficus (*Ficus benjamina*) as well as using 2.54cm by 2.54 cm (1-inch by 1-inch) vinyl-coated wire ceiling mesh. Humidity in the exhibit is approximately 85% RH and the temperature ranges between 28C and 32C (approx. 82F and 89F). The exhibit has been the backdrop to many unique observations including social interactions and reproductive behaviors of sloths.

Sloths

The National Aquarium has housed *C. didactylus* in the Rain Forest exhibit since 2007 when the Aquarium acquired 1.2 individuals. The three sloths, Sid, Rose and Ivy, spent approximately 60 days in quarantine prior to moving to on-

Photo by Debra Dial

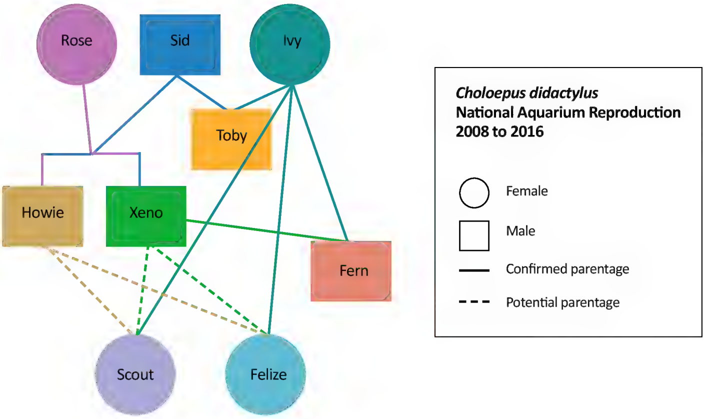


Figure 1. Six offspring have been born at the National Aquarium between 2008 and 2016. Offspring which have multiple sire potential are depicted with dashed lines.

exhibit transitional housing ('howdy' enclosure) within the Rain Forest. After an acclimation period of one week, the animals were allowed unrestricted access to the exhibit. Through the years, the Aquarium's sloth population has changed with the loss of an adult, the birth of many offspring and the transfer of sloths to other institutions.

Social Dynamics

At the Aquarium, individual sloths have been housed in varying social groupings, demonstrating a snapshot of the dynamics between male-male, offspring-parents, as well as female-female. The highest number of animals exhibited together simultaneously was five individuals on two separate occasions between 2012 – 2013 (four males, one female) and 2013- 2014 (three males, two females).

Social observations have been either direct or inferred (made post-suspected event) due to the nocturnal nature of sloths. On several mornings staff suspected aggression between

Choloepus didactylus Hand-rearing Guidelines

Protocol adapted from Sloth Sanctuary of Costa Rica, Cahuita CR and National Aquarium, Maryland USA

Weeks 1 to 4 feed 12x daily including overnight
- 5-10 ml goat's milk every 2 – 3 hours including overnight
- Decrease overnight feeds slowly toward the end of 4 weeks
- Offer Pedialyte® by syringe

Weeks 4 to 8 feed 6x daily, decrease overnight feeds
- Feed 8-15 ml of goat's milk every 4 hours

Weeks 5 to 6
- Introduce a new vegetable each week, ideally following fecal output
- Vegetables may include carrots, squash, zucchini and sweet potato
- First solids should be steamed green beans
- Second week of solids introduce goat's milk-soaked manufactured leaf-eater pellet such as Mazuri® Leaf-eater biscuit
- Add Enfamil® Poly-vi-sol® multi-vitamin, one drop daily

Beyond week 8 feed 5x daily, discontinue overnight feeds
- Strengthen milk by adding 8 ml (1.5 teaspoon) of additional powered goat's milk formula
- Increase goat's milk intake to 80 ml over 12 hours
- Discontinue Pedialyte® by syringe
- Offer water by syringe

Between weeks 10 to 12
- Add hard-boiled egg to one feed every other day
- Add a fruit each week, ideally following fecal output

Beyond week 14 feed 4x daily
- Offer solids prior to offering milk

Week 20 feed 3x daily, leave overnight bowl
- May wean to solids only
- Sloth Sanctuary of Costa Rica offers goat's milk to infant sloths for at least 10 months old unless the animal loses interest earlier

Beyond 30 weeks feed 2x daily, leave overnight bowl
- Continue to monitor food intake and fecal output

Beyond 38 weeks feed 1 – 2x daily
- Self-feeding

Figure 2. National Aquarium's two-toed sloth hand-rearing guidelines. Guidelines adapted from Sloth Sanctuary of Costa Rica located in Cahuita, Costa Rica and modified following successful rearing of an orphaned infant sloth.

Disinfection Routine
Sample Schedule

Following each feed
- Hand-wash items with soapy hot water independently of other dishes
- Add items to water and disinfectant (such as Chlorhexidine 2%) Follow product instruction for dilution
- Rinse items and place in drying bin for next use.

Daily
- Change the disinfectant/water
- Wash and replace soiled linens

Monday, Wednesday and Saturday
- Clean soiled stuffed animal with soapy water and a rag
- Allow stuffed animal to air dry

Weekly
- Replace feeding syringes and rubber feeding tip
- Boil bottles and nipples
- Wash sling

sexually mature male sloths after the appearance of facial lacerations and forefoot wounds. This theory was quickly confirmed when the violence escalated and daytime observations of fighting between males was noted between 2013 - 2014.

The confirmation of male to male aggression led to the decision for the Aquarium to exclusively house sloths as a harem group (one male, multiple females).

Reproduction

Since 2007, the Aquarium's sloths have produced 4.2 offspring; Howie, Xeno, Toby, Scout, Felize and Fern (in birth order). Although each pregnancy was suspected, they were not confirmed. It should be assumed that if a male and female sloth are at sexual maturity the potential for pregnancy is there despite the lack of notable behavior or appearance changes. Two-toed sloths have an estimated gestation of 10 months (variation in estimates exist) that does not appear to be seasonal (Taube et al., 2008). Births have occurred at the Aquarium in the months of February, March, April, August, September and November. The six offspring were born at the National Aquarium from 2008 to 2016 by two different dams and multiple sires. (Figure 1)

Confirmation of pregnancy through ultrasound may be difficult due to the sloth's anatomy. The ventral location of the bladder, which when full can hold up to a liter of urine (Gilmore, Da-Costa and Duarte, 2000), may obstruct the view of the dorsally-located simplex uterus. A lateral approach may be more successful.

Conception date was not known for any of the Aquarium's offspring; date of birth along with the assumption of gestation length was used to estimate a dam's age at the time of conception as well as inter-birth intervals. Dams: Rose and Ivy were between approximately 2 years 10 months old and 10 years 5 months old at the time of births. Sires: Sid, Howie and Xeno ranged in age from approximately 2 years old to 6 years old at the time of their offspring's births. Rose had an inter-birth interval of approximately 17 months between her two offspring. Ivy averaged 14 months between her four offspring. Ivy also conceived three times while still carrying dependent offspring. At the time of calculated conception, dependents were approximately 4 months 28 days, 6 months 14 days, and 2 months 26 days old.

Howie was born on exhibit to Rose on September 2, 2008 (+/- 2 days) a little less than a year after the exhibit's founding sloth trio's introduction to the forest. Rose reproduced a second time giving birth to Xeno on February 18, 2010. Six weeks following Xeno's birth, Rose was found dead on exhibit unexpectedly from (what was later determined to be) pneumonia. Xeno was hand-reared by staff, successfully released into the exhibit and sired offspring at sexual maturity.

In 2012, Ivy reproduced for the first time and by 2017 had produced 2.2 sloths; Toby, Scout, Felize and Fern. Following

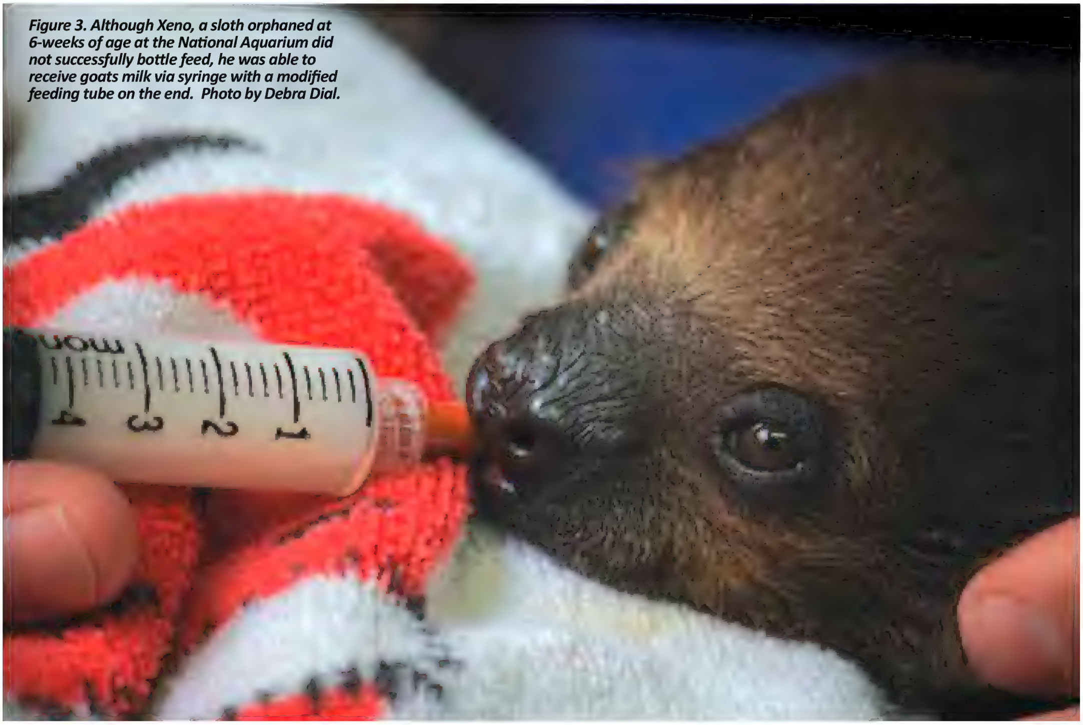
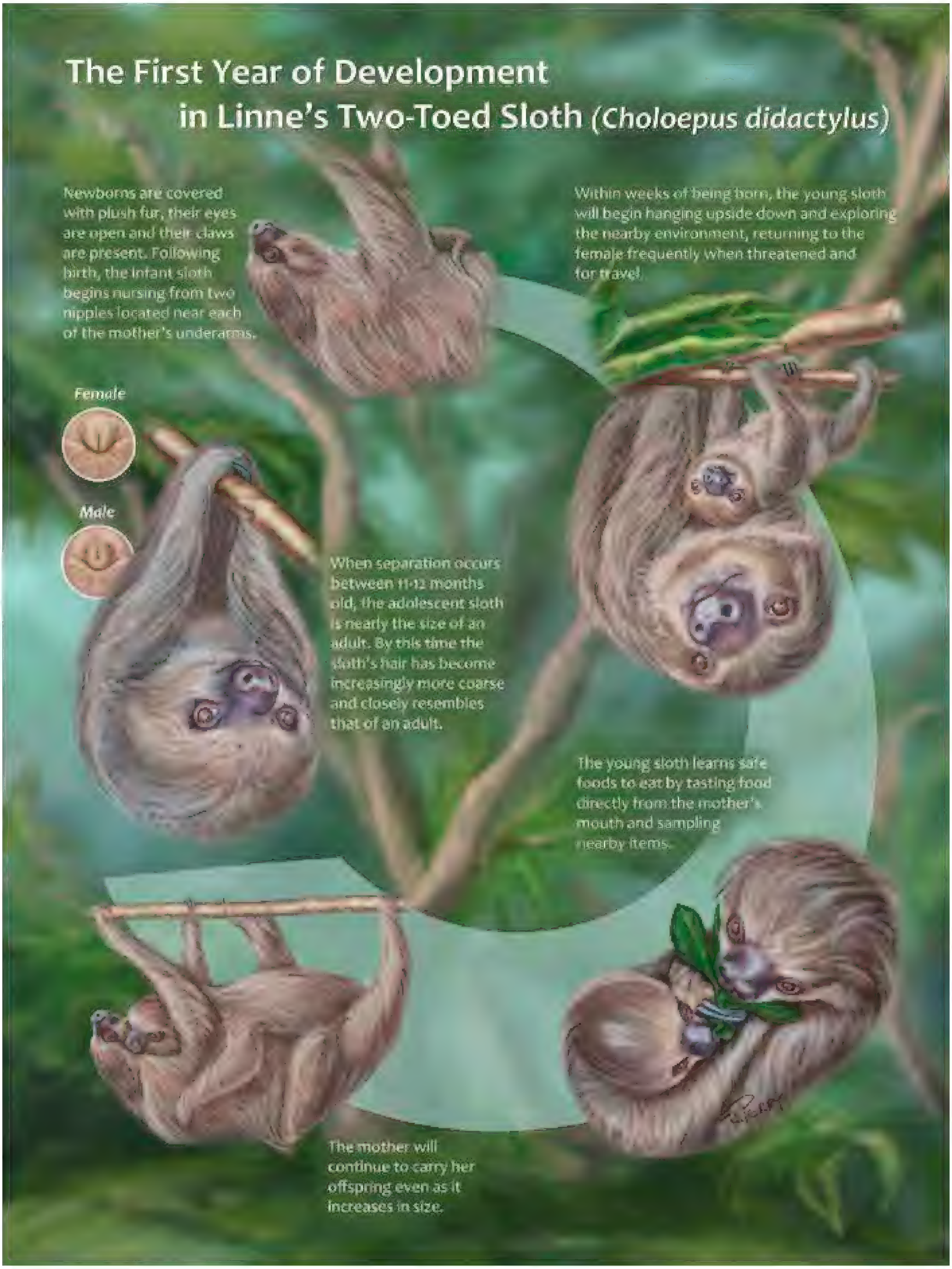


Figure 3. Although Xeno, a sloth orphaned at 6-weeks of age at the National Aquarium did not successfully bottle feed, he was able to receive goats milk via syringe with a modified feeding tube on the end. Photo by Debra Dial.

The First Year of Development in Linne's Two-Toed Sloth *(Choloepus didactylus)*



Newborns are covered with plush fur, their eyes are open and their claws are present. Following birth, the infant sloth begins nursing from two nipples located near each of the mother's underarms.

Within weeks of being born, the young sloth will begin hanging upside down and exploring the nearby environment, returning to the female frequently when threatened and for travel.

When separation occurs between 11-12 months old, the adolescent sloth is nearly the size of an adult. By this time the sloth's hair has become increasingly more coarse and closely resembles that of an adult.

The young sloth learns safe foods to eat by tasting food directly from the mother's mouth and sampling nearby items.

The mother will continue to carry her offspring even as it increases in size.

Figure 4 (opposite page). As two-toed sloths mature they experience many changes including sexual features becoming more distinct. At maturity, the male sloth genitalia have a center opening on a mound whereas the female's openings form the shape of an anchor.

The First Year of Development in Linne's Two-toed Sloths (Choloepus didactylus) courtesy of Dial D. et al., National Aquarium, Baltimore, Maryland USA Illustrated by R. Perry, © 2015, Johns Hopkins University. Used with permission.

the birth of Scout, the placenta was found on exhibit and was submitted to the Aquarium's Animal Health team to evaluate for infection, inflammation, or abnormalities which may have occurred in utero. On the morning of Fern's impending birth, Ivy climbed to Aquarium staff who were working in the Rain Forest exhibit. Staff immediately concluded from her unusual posture and the periodic appearance of membrane at her vaginal opening that she was in labor and provided her access to an on-exhibit 'howdy' enclosure. Approximately twenty minutes after entering the 'howdy', staff witnessed Ivy giving birth to Fern. The newborn dangled briefly under Ivy attached to her by the umbilical cord before climbing onto dam's chest. Like all sloths, Fern was born covered with fur, eyes open, nails, and teeth were present. Once the infant was on Ivy's abdomen, she cleaned its face by licking, chewing and then ingesting the fetal membrane. The infant Fern made its way to Ivy's nipple and within minutes began nursing. The placenta was passed within a couple of hours following birth and was collected for submission to the veterinary team to evaluate for abnormalities.

From birth to six weeks old, keeper staff check on the dam and infant a minimum of three times daily. The Aquarium treats the initial six-week post-partum period as a time that has the greatest risk to the dam and the highest risk for the infant, particularly if the infant falls from the dam. From six weeks to six months of age, staff seek out the dam and infant twice daily and after six months of age, just once daily until separation occurs. Infant sloths are not separated from the dam by Aquarium staff until natural separation has occurred. *Choloepus* become independent between 9 – 12 months of age (Taube et al., 2008). Prior to complete separation, offspring may spend months sleeping beside dam when the pair is at rest. Separation at the Aquarium has been very distinct with dam and offspring found in locations far from each other in the morning and never seen together after that point. In-care at the Aquarium, dam and infant natural separation has occurred at; 11 months 29 days, 11 months 3 days, 11 months 27 days, 10 months and 1 year 27 days. Prior to separation juvenile sloths are microchipped while still on the dam at around 9-10 months of age. Regardless of sex, parent-raised or hand-reared by staff, young sloths at the Aquarium have had similar weights at 10-months of age; Toby, 1.0 at 319 days old - 3.4kg, Felize, 0.1 at 315 days old 3.7kg, and Xeno, hand-reared 1.0 at 317 days old 3.9kg.

Within the first week of life at the Aquarium, infant sloths have been observed tasting plants when stems or leaves are nearby. Within weeks they have been seen eating vegetable matter. As infants age they have also been seen sampling food items directly from the dam's mouth and continue this practice until separation occurs. Infants nurse from two small nipples located near the axillae.

Hand-rearing

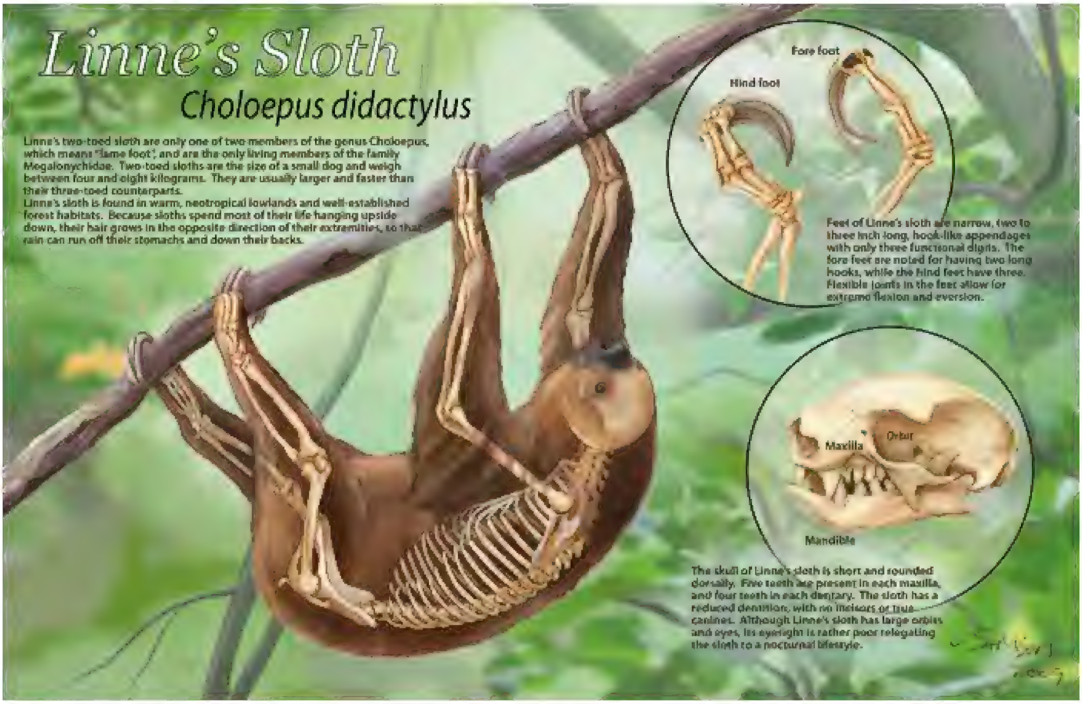
Exhibits which house a sexually mature female and male sloth together should be prepared to hand-rear an infant sloth in the event of an issue with the infant or dam post-birth. The National Aquarium keeps on hand a "kit" in the event of such an emergency. The kit includes two 354mL (12 us fl oz) canisters of powdered Meyenberg goats milk (Meyenberg, Turlock, CA, USA), Monoject ™ 12 cc syringes (Medtronic, Minneapolis, MN USA), Kendall sterile feeding tube (Medtronic, Minneapolis, MN USA), a heating pad, Pedialyte® (Abbott Laboratories, Lake Bluff, IL USA), human infant sling (Hotslings, Pleasant Grove, UT USA), Salter 914 Pediatric Scale (Taylor USA, Oak Brook, IL USA), PetAg 118mL (4 us fl oz) bottle nursing kits (PetAg, Hampshire, IL USA) and two stuffed animals (to use as surrogates) approximately 60cm to 390cm in length. A ProCare Critical Care Unit 18 (Lyon Technologies, Chula Vista, CA USA) is available in the event an infant is critically ill or must be hand-reared from a very young age.

Sloth milk is higher than cow's milk in minerals and vitamins important for processes involving development of dentition, energy, and ossification as well as higher in fat composition at 6.9% and protein at 6.1% (Gilmore, Da-Costa and Duarte, 2000). Cow's milk is not an acceptable substitute for sloth milk and only goat's milk should be offered to infant sloths at the Aquarium.

Photo by Debra Dial.

After the unexpected death of Rose from pneumonia, National Aquarium staff hand-reared the 6-week-old infant, Xeno. A hand-rearing protocol (Figure 2) was developed with the aid of Sloth Sanctuary of Costa Rica located in Cahuita, Costa Rica. Xeno never accepted a bottle but did receive goat's milk via syringe with a modified attached feeding tube (Figure 3). He was ultimately released back into the Rain Forest exhibit at approximately 1 year 5 months old.

Infant sloths in human care should be held often and benefit from contact for the first four months. Daily records should be kept including food items offered, fecal/urine output and daily weight taken prior to first feed of the day. Infant sloths should be fed belly-down until approximately 4 months old. A stuffed animal should be provided for infants as a surrogate mother, with care taken to remove eyes and other potential choking hazards. A second stuffed animal should be available to rotate and allow for proper laundering. Very young infant sloths should primarily stay on the stuffed animal 'surrogate' including



Linne's two-toed sloth are only one of two members of the genus Choloepus, which means "lame foot", and are the only living members of the family Megalonychidae. Two-toed sloths are the size of a small dog and weigh between four and eight kilograms. They are usually larger and faster than their three-toed counterparts.
Linne's sloth is found in warm, neotropical lowlands and well-established forest habitats. Because sloths spend most of their life hanging upside down, their hair grows in the opposite direction of their extremities, so that rain can run off their stomachs and down their backs.

Feet of Linne's sloth are narrow, two to three inch long, hook-like appendages with only three functional digits. The fore feet are noted for having two long hooks, while the hind feet have three. Flexible joints in the feet allow for extreme flexion and eversion.

The skull of Linne's sloth is short and rounded dorsally. Five teeth are present in each maxilla, and four teeth in each dentary. The sloth has a reduced dentition, with no incisors or true canines. Although Linne's sloth has large orbits and eyes, its eyesight is rather poor relegating the sloth to a nocturnal lifestyle.

Figure 5. Two-toed sloth dental arrangement consists of five teeth in each maxilla and four in the dentary bone. Linne's Sloth, Choloepus didactylus courtesy of Howell K. et al., National Aquarium, Baltimore, Maryland USA. Illustrated by J Samson, © 2010, Johns Hopkins University. Used with permission.

while in the incubator and being transported. Infants should be kept in an incubator or isolette until 3 months of age at a temperature between 24C and 28C (75F and 82F). Perching should also be provided after 4 months of age including perching that touches the ground to provide an area to defecate. Opportunities should be provided for climbing practice.

Although this has not occurred at the Aquarium, premature separation (dam/infant apart prior to natural separation) may happen, i.e., if an infant sloth falls from the dam. If this were to occur, attempts would be made to reunite the pair. If adequate nutrition is a concern, the infant sloth can be supplementally fed by keeper staff while the infant remains with/on the dam in lieu of separation.

Best practices do not remove infants unnecessarily from the dam until natural separation has occurred.

Sexing

Two-toed sloths can be difficult to properly sex, especially when animals are immature. Skin folds and the lack of definitive features make males and females appear similar. Adult males have a distinct mound with a uro-genital opening in the center. The anus is located posterior to the mound and is separated by an area of skin. Female sloths have a slotted vaginal opening which seemingly terminates into the anus leaving skin openings which resemble an anchor (Figure 4). To avoid misidentification, the Aquarium waits to positively identify the sex of animals until they are a minimum of 6 months old. Sexing from DNA (hair sample) is also encouraged to provide reliable sexing information.

Anatomical Considerations

Sloth feet and nails pose unique challenges in captive situations and must be properly maintained to prevent injury. Aquarium staff monitor sloth nails for length and curvature to ensure the sloths mobility is not impaired while traveling along exhibit wire. Nails which begin to curve inward towards the foot pad must be trimmed to prevent feet being caught on the Aquarium's vinyl-coated wire. Plier-style large canine nail clippers (Millers Forge Pet Products, Plano, Texas USA) work well for trims. The blood supply of the nail appears to be close to the nail bed even when nails are very long. Angled nail pieces are often found on exhibit with no obvious injury to sloths suggesting the nails may break readily and on a natural plane. Healthy foot pads should be shiny and lack flaking and cracking.

Sloths possess a unique simplified dentition. Sloths lack enamel on their teeth resulting in a yellow coloration, which may be misinterpreted as a potential dental problem. Two-toed sloths possess a 5/4 dental formula (five upper per side and four lower) (Figure 5) consisting of triangular anterior caniniforms and posterior molariforms (separated by a diastema),

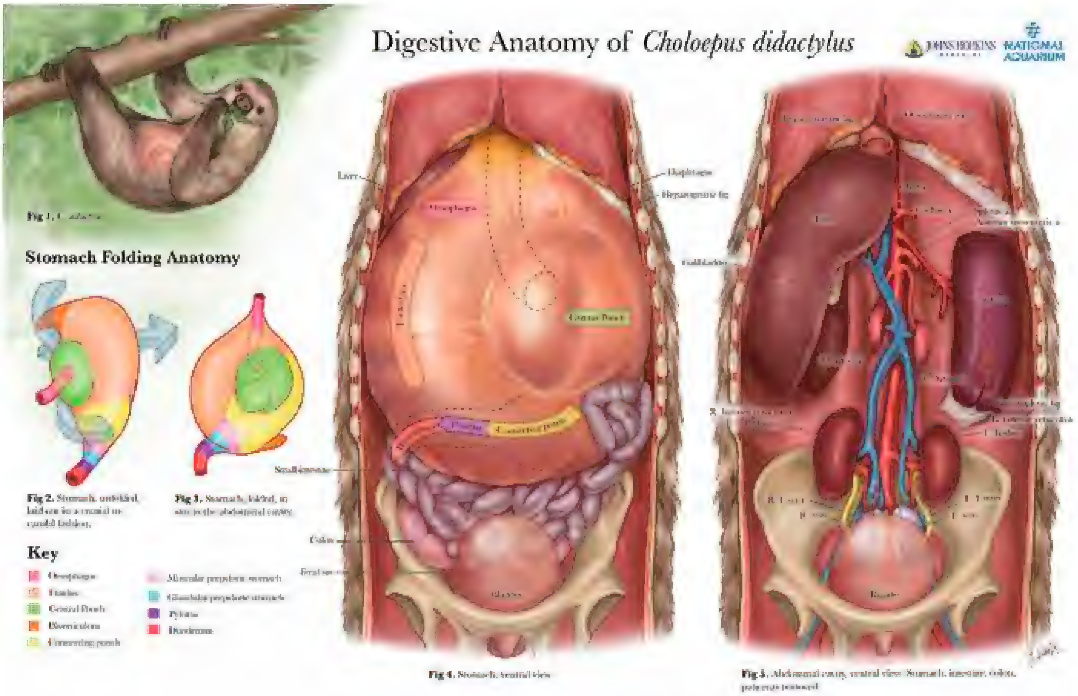

Digestive Anatomy of Choloepus didactylus
JOHNS HOPKINS
NATIONAL AQUARIUM
Stomach Folding Anatomy
Fig 2. Stomach, unfolded, laid out in a cranial to caudal fashion.
Fig 3. Stomach, folded, as seen in the abdominal cavity.
Key
Oesophagus
Fundus
Central Pouch
Diverticulum
Connecting pouch
Muscular prepyloric stomach
Glandular prepyloric stomach
Pylorus
Duodenum
Liver
Diaphragm
Gallbladder
Central Pouch
Connecting pouch
Small intestine
Colon
Fig 4. Stomach, ventral view
Fig 5. Abdominal cavity, ventral view

Figure 6. The two-toed sloth's abdomen is dominated a very large stomach where digesta moves between partially separated sacs (central pouch, fundus, and connecting pouch) before moving through the rest of the digestive tract. Digestive Anatomy of Choloepus didactylus. Courtesy of Dial D. et al, National Aquarium, Baltimore, Maryland USA. Illustrated by L. Kethu, © 2018, Johns Hopkins University. Used with permission.

which also lack roots. (Hautier et al., 2016) The sloth's hyoid region is well developed with a muscular tongue that moves food from the teeth to the ridged palate for mastication and back again as needed until a bolus of food if formed and swallowed (Naples, 1986).

If sloths are too hot or become excited, droplets of sweat may appear on the nose. Animals should be able to self-regulate their temperature if alternative cooler locations are present in their enclosures. If environmental temperatures are too cold, sloths have a challenging time thermoregulating their body temperature due to their inability to increase their metabolism. Sloth body temperatures range on the low side for mammals, from 32.7C to 35.5C (90.86F to 95.9F) (Gilmore, Da-Costa and Duarte, 2000).

Diet and Digestion

Two-toed sloths are folivorous, non-ruminant foregut fermenters and as such have low metabolic rates and process digesta very slowly. (Vendl et al., 2015) When full, a sloth stomach may weigh as much as one third of its body weight (Vizcaíno and Loughry, 2008). The abdominal ventral view is dominated by the stomach and intestines (Figure 6). Sloths are short-sighted and rely on additional senses for food finding. (Gilmore, Da-Costa and Duarte, 2000) Healthy feces should be pelleted and variables exist in the rate that feces are produced.

The generalist diet of two-toed sloths lends itself well to adapting to captive situations (Vendl et al., 2015). The National Aquarium's sloth diet is based on 70% vegetables with low simple sugars, 30% manufactured pellet, and occasional fruit. Each adult sloth is provided a diet of 245 grams of produce such as zucchini, squash, sweet potato, and carrot, and 100 grams of Mazuri® leaf-eater primate biscuit (Land O'Lakes Purina Feed LLC, Richmond, Indiana USA) per day. Produce is cut in long wedge shapes approximately ½" wide by 3" long to allow the animals to pick up individual pieces and hold them with their forefoot. The diet is supplemented with Vionate®, a vitamin and mineral powder (Miracle Care Pet, Moraine, OH USA) and Repashy Supercal NoD calcium (Repashy, Oceanside CA USA) which is mixed with vegetable oil to increase palatability before being drizzled onto produce. Fresh water is always accessible and some animals may preferentially drink from dripping or flowing sources.

Identifying

Identifying individual sloths is essential to following life events and providing optimal care. The National Aquarium utilizes Tracks® software (Tracks® Software, Salida, Colorado, USA), a program which manages animal data, livestock crayons, and Avid® PIT tags to identify animals. Prima Tech® livestock crayons (Prima Tech US, Kenansville, NC USA), also known as animal marking sticks, are commonly used in agriculture to identify animals. For sloths, the coloration can be applied directly to

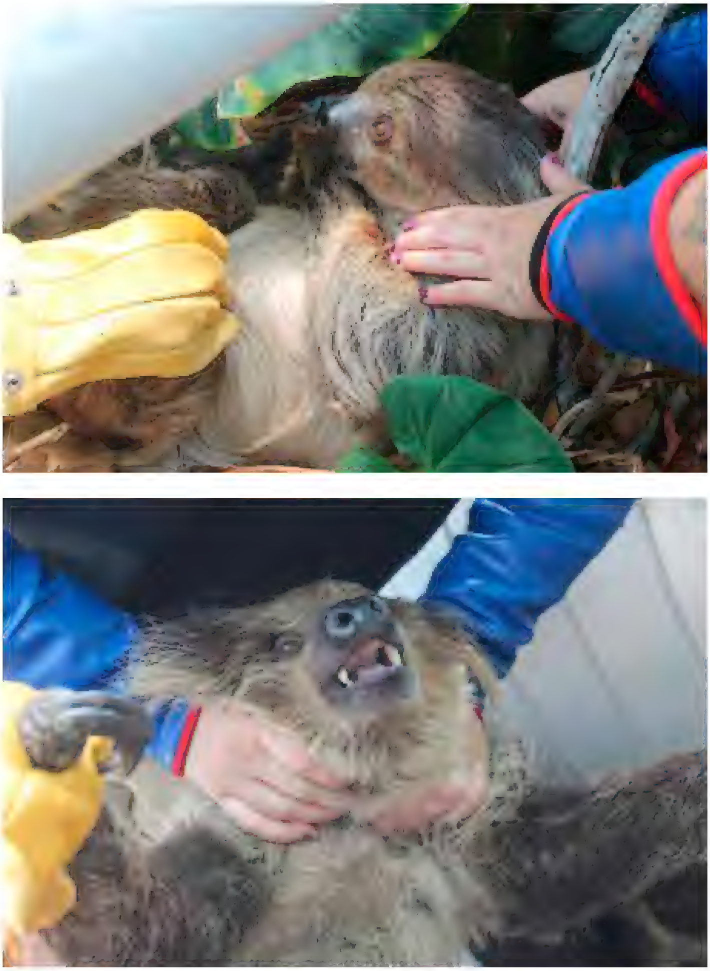


Figure 7a and 7b. A two-toed sloth's head should be securely restrained to protect staff and the animal from injuries during moves. Care should be taken to avoid restricting the sloth's ability to breath. Proper hand placement should be thumbs below the ears and towards the back of the skull while the handler's fingers are placed under the sloth's mandible. Photos by Debra Dial.

the hair of the rump and can be easily viewed from a distance when the animals are high in trees. To reduce pressure on the animal when applying the crayon, it is helpful to place a hand behind the hair. Although this coloration must be reapplied periodically (every 2 to 3 weeks) it is an excellent tool for individual recognition via binoculars. In addition to color, animals also receive microchips subcutaneously. The Avid® PIT tags (Avid Identification Systems, Norco, California USA) can be checked using a handheld scanner which reads the radio frequency and displays each animal's unique combination of numbers and letters.

Handling

Handling two-toed sloths safely requires well thought-out planning and multiple staff. Prior to handling, care should be taken to gather supplies and assign staff to roles in advance. Individual staff members should be assigned to restrain areas of the sloth's body (head, front legs, rear legs) to keep the animal and staff safe. The animal should be restrained in a sequence which makes sense for the scenario but as a general protocol Aquarium staff restrain in the order of head, front legs and lastly rear legs. The staff member holding the head must grip firmly but should take care to not restrict breathing. The hand placement for a proper head hold of a two-toed sloth should place the handler's thumbs below the ears and towards the back of the skull while their fingers hold under the sloth's mandible (Figure 7a and 7b). The "lead" should be identified in advance to ensure staff hear only one voice and receive clear direction. Protective equipment can be helpful in preventing injuries to staff from the sloth's nails or teeth. Protective, padded sleeves such as BiteBusters® Nitrile/Kevlar® sleeves (Bitebuster, LLC. Gilbert, AZ USA) are ideal for the staff member securing the animal's head in order to prevent sloth nails from puncturing the handler's forearms. If gauntlet gloves have space or holes, cover these areas with tape to prevent nails from hooking the gloves and trapping the handler. Staff members whose roles are securing front legs, can benefit from full length Kevlar® (DuPont™, Wilmington, DE USA) gloves. This role has caused the most staff injuries which occur when the sloth is able to draw the handler into their mouth. Adult sloths may not let go immediately once they have bitten and may need to have their jaws manipulated for release. In less dangerous handling positions such as the rear legs, a simpler animal handling glove like the Duty Animal Glove (Animal Care Equipment and Services, Broomfield, CO USA) can be used to protect a handler from the animal's nails.

Out of Reach

Sloths can be challenging to manage on exhibit, particularly when being housed in large spaces and out of physical reach. Some common difficulties such as animals resting in undesirable places or the inability to check the welfare of a sloth through visuals can be mitigated through effective exhibit design.

The amount of time animals spend in non-preferred areas can be adjusted by directing light towards those areas as a deterrent. Thoughtful planning utilizing plants/trees/perching also works well for allowing and restricting sloth access to areas. Providing strong, secure trees/perching works well to promote ideal areas.

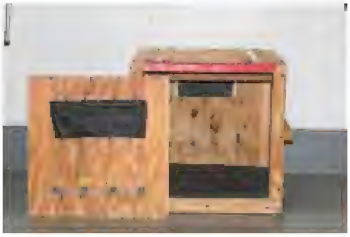


Figure 8. Two-toed sloths transport well in custom crates. A wooden hanging dowel should be installed that is 5.08cm (2") in diameter. The crate should have rubber matting on the floor to cushion the animal while it is resting on the bottom.

For general wellness checks, it may be necessary to occasionally rouse a sloth that has spent many days in the same place to ensure the animal is okay. This can be non-invasively done with the use of a battery-operated back massager secured to the bottom of the tree. Attaching the massager using something non-abrasive such as nylons or pantyhose will ensure the tree does not suffer damage. The vibration travels through the tree's trunk and can be felt by the sloth causing it to wake. Although sound may be effective to wake a sloth on occasion it is not always a guarantee and the appropriate frequency is needed to do so. The two-toed sloth has a small number of ganglion cells (cells found in the cochlea of the ear which transmit sound from cochlea to brain) which suggests sloths can hear low frequency sounds (Gilmore, Da-Costa and Duarte, 2000). This is an important consideration when attempting sound as a tool for animals in-care. The Aquarium has found vibration to be a more efficient and effective method.

Training

Training sloths to follow a target and to recall to a sound cue provides great husbandry benefits including close daily visuals and the opportunity for preventative care to occur without removing the animal from the exhibit. Acrylic lollipop target sticks or buoy targets with handles work well for sloths. Particularly in the early stage of target introduction it can be helpful to mark appropriate responses with a clicker. In addition to target, it is very beneficial to train a recall behavior. The National Aquarium uses a wooden castanet as the sound cue for sloths on exhibit in the Rain Forest. Staff pair the castanet sound with produce from the daily diet as their primary reinforcer.

Although, two-toed sloths move very quickly when they desire to, they can be slow to wake during daytime training sessions and responses appear to be slightly slower than their equally-sized mammalian counterparts. Sloths housed in large exhibits may need to be opportunistically reinforced with the cue until there is a clear association.

Transport

Sloths can be transported by land or air safely in wooden shipping crates. Care should be taken to review the International Air Transport Association (www.IATA.org) regulations and guidelines for shipping two-toed sloths. An adult male sloth can be moved in a 55.88cm x 55.88cm x 57.15cm (22" h x 22" w x 22.5" d) wooden crate. Crates should have a wooden dowel 5.08cm (2") in diameter installed and be outfitted with a vertical sliding front door (Figure 8). The bottom of the crate can be cushioned with rubber matting such as Nomad ™ matting (3M Products, Maplewood, MN USA). Prior to transport, food and water should be added and the sliding door secured by drilling wood screws through the door and into the body of the crate. Ventilation windows should be meshed with two layers of hard wire screening and shade cloth should be installed on the exterior of each window. Care should be taken to ensure environmental temperature is appropriate for travel (greater than 70F, less than 90F) to prevent exposure to cold or extreme heat.

Conclusion

Excellent welfare for sloths in-care requires knowledge of natural history and a good understanding of husbandry. Sloth care should include attention to social structure and preparedness for potential reproduction. Best practices should promote infants staying with dams until natural separation has occurred. Exhibits should be thoughtfully arranged based on the sloth's unique anatomy and manipulation of exhibit features may be necessary to encourage or discourage space use. Sloths in-care should be identified as individuals to properly track life events. Diet should reflect foods appropriate for their digestion. Staff and animal safety should be a consideration any time a sloth is handled. A ten-year husbandry review at the National Aquarium has provided opportunity to reflect on successes and adjust care as needed.

Photo by Debra Dial.

Acknowledgements

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Training 0.2 Ostriches for an Annual Exam

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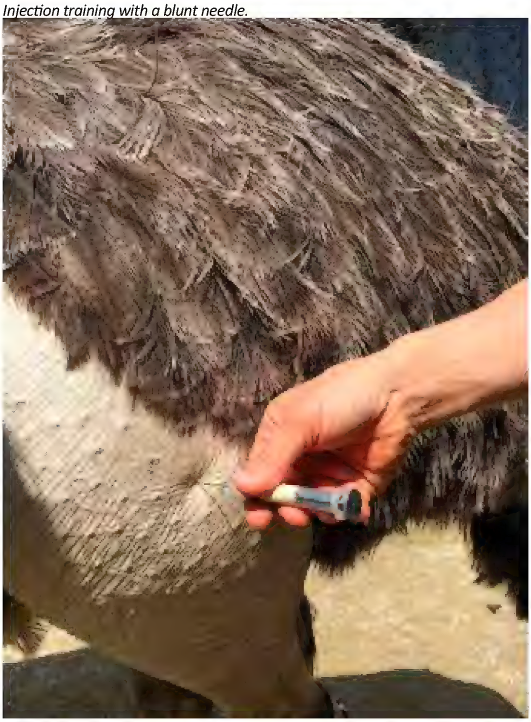
Introduction

In June 2014, The Cincinnati Zoo & Botanical Garden acquired two female ostriches (*Struthio camelus*) to be part of their new African savanna exhibit. The exhibit was to be comprised of three species of hoofstock and seven species of birds, and all animals in the exhibit were intended to be worked free contact. With creation of the exhibit, the need to train the ostriches in various behaviors became apparent. Keeper staff consulted with the veterinary staff and it was decided to train the birds for a full annual exam. The exam was to include; blood draw, injection, scale, touch, wing and tail manipulation, stethoscope, and mirror box.

Injection training with a blunt needle.



The beginning of the ostrich training program proved challenging. Both birds, Pam and Rose, had very different demeanors. The larger female, Rose, was very keeper-oriented and seemed to enjoy interacting with staff. The smaller female, Pam, was much more reserved but did not show any signs of aggression.

The first goal in the training program was to find an effective reinforcement method. Initial attempts included: hand feeding produce and using Mazuri® Ratite Diet from their daily diet. These attempts were only marginally successful, as produce was not a favorite of the birds, and Pam was not motivated by the ratite pellets. Ultimately Mazuri® Waterfowl Maintenance was found to be an effective reinforcement for both ostriches. The best delivery method for the food was use of a square container.

The initial training routine with each bird centered on building appropriate relationships between the ostriches and keepers. Since Rose was already comfortable with staff, this meant extinguishing undesired behaviors, such as pecking at keepers and stealing food before it was offered to her. With Pam, the initial training focus was building trust between her and staff, and encouraging her to consistently approach keepers for food. With a solid routine established and both birds being used to coming in and receiving food when called, more complicated behaviors could be established.

Blood Draw Training

With a solid training routine established with both birds, the focus of the program shifted to performing blood draws. After consulting the zoo's veterinary department, it was decided to attempt to draw blood from the medial metatarsal vein in the bird's lower leg, due to the large size of the vein. Safety was a top priority during these training sessions, and as a result staff were diligent about keeping sessions positive for both birds. It was determined that the safest way to access the vein was to have the birds stand with the leg closest to the person drawing blood in front of the leg that was to be drawn from. This ensured that staff were not reaching in front of one leg to access the

Rose on the Mirror Box.

Stethoscope Training.

Tail manipulation.

other, thereby minimizing risk as much as possible.

Training with Rose rapidly progressed due to her comfort with keepers, and willingness to be touched. Rose readily accepted the presence of a second trainer. One trainer would be by her head, offering her food, while the second trainer would be interacting with her in another way, described in subsequent paragraphs. She quickly fell into the routine of stepping forward when asked, and did not react to the second trainer bending down and touching the inside of her leg. In preparation for an actual blood draw, Rose was desensitized to the alcohol sterilization pad by having her leg wiped with a damp gauze. Initially, the vein was poked with a blunt needle to simulate an actual venipuncture. Rose showed virtually no reaction to her lower leg being touched with the blunt needle. The most time-consuming part of her blood draw training was building up the amount of time she would be required to stand still in the necessary position. The final stage of the blood draw behavior involved integrating the veterinary technicians into the training, whom Rose readily accepted. When the time came to actually draw blood, Rose did not show any adverse reaction to being poked with the needle. The veterinary staff was able to successfully collect blood, without causing Rose any apparent discomfort or distress.

Blood draw training took significantly longer with Pam due to her uneasiness around keepers. Staff had to experiment with different scenarios to ensure a successful outcome. Early training sessions with Pam involved asking her to stand in the center of a stall with only one trainer working on touch desensitization to her upper body. Gradually, over a period of weeks, the trainer would move towards touching her abdomen and finally her legs. Unfortunately, this training method proved unsuccessful after several weeks of training and a new method was devised.

After several weeks of trying different training methods, including adding a second trainer to her stall and changing her standing position within the stall, it was found that she was most successful in training by standing with one side against a stall wall and a trainer on the other side of her performing desensitization behaviors. When all desensitization training was occurring, another trainer was near her head offering her food.

At this point trainers began to ask Pam to stand in a position that would be needed for an actual blood draw, which she readily provided. Despite being more comfortable during training sessions, Pam was still unwilling to allow trainers to touch her abdomen or wings. However, she would allow trainers to touch her leg, although with clear hesitation. Overall, she appeared to tolerate her legs being touched much more than her upper body. With this new insight into Pam's tolerance for interaction, training shifted towards getting her comfortable with staff crouching down next to her, as if to do an actual blood draw. Talking to Pam while squatting straight down yielded the most positive results. The next step was to work on touch desensitization in preparation for blood draws. While Pam did react initially to being touched, she progressed quickly and allowed staff to wipe the area with a damp gauze, and poke her vein with a blunt needle. Building standing duration in the blood draw position took longer than it did with Rose, however she did make steady and consistent progress. The final phase of Pam's training involved integrating the veterinary staff into the blood drawing behavior. This was a major setback for Pam, as she did not accept new people being integrated into her training routine well, but by having them present for training sessions at least once a week, they were successfully integrated into her routine. On the first attempt to draw blood from Pam she did break away shortly after being poked, however she quickly came back into alignment, and a small amount of blood was collected. A week later veterinary staff was able to collect enough blood to run a full blood panel.

Scale Training

During blood draw training, staff were also working on acquiring weights with both ostriches. Fortunately, the barn where the ostriches were held was equipped with an in-ground scale. It was decided to condition the birds to walk over the scale as part of their

Ostrich feet on mirror box.

training routine as opposed to formally training the behavior. When the birds were reluctant to walk across the scale, they were baited and then reinforced when they were on the scale. While not a formally trained behavior, both ostriches are able to be easily weighed on a routine basis.

Body Manipulation Training

Following the successful completion of the blood draw behavior, staff began to work on touching the bird's abdomens and manipulating their wings and tail. The goals for this behavior were to feel along the birds back, manipulate the wings to determine if there were any limitations in motion, feel the sternum to assess body condition, and move the tail to allow for visual cloaca checks.

Since Rose was already comfortable being touched, very little actual training was needed for this behavior aside from having her hold still, which she had mastered during blood draw training. Therefore, veterinary staff were quickly able to complete this portion of her exam. Training Pam for the body manipulation portion of the exam proved trying, as she had shown reservations with being touched throughout the entire training process. During this stage in Pam's training, it was crucial to monitor her for signs of stress. When Pam was overwhelmed by a training session, she would walk away and would not come back, prematurely ending the session. Keepers later noticed that when Pam was pushed too hard in a training session, she would stop swallowing her food and briefly freeze before walking away. Keepers were able to use this signal as a visual cue, and would give her a break in training. If she was willing to eat again, the second trainer would briefly engage her before ending the session.

By paying close attention to her body language, a majority of Pam's training sessions ended on a positive note, ensuring continued forward progress. Keepers found that Pam responded best to being touched on her back-end close to her tail. This was used as a starting point, and trainers gradually moved their hands forward towards her wings. Once Pam was making progress on having her abdomen touched, trainers began manipulating her wings, gently moving them in and out.

Blood draw training.

Progress was slow but consistent; gradually her trainers were able to reach under her wing and across her chest to check her sternum. The final stage of training was to allow staff to move her tail for cloaca checks. Since Pam was more comfortable with trainers touching the back half of her body, this proved to be an easy behavior to add to her repertoire. Veterinary staff was often present during this part of her training, allowing her to be used to having this behavior performed by various people.

Stethoscope Training

Building upon the touch behavior, we next focused on stethoscope training. The goal of this behavior was to listen to the bird's heart and lungs. This was a fairly easy transition for both birds, as they were both used to being touched, and just needed to become accustomed to the feel of the stethoscope. Rose quickly adapted to the stethoscope being placed on her body. With her willingness to being touched, veterinary staff were able to locate the best place to listen to heart and lung sounds. This proved beneficial when trying to minimize contact with less willing birds, such as Pam. The goal was to be able to listen to the birds' heart and lung sounds for approximately thirty seconds.

Not to be unexpected with Pam, we faced a minor hurdle, as she did not initially allow us to touch the same spot for an extended period of time. We worked to gradually increase the amount of time she was being touched by reinforcing her at variable time intervals. Reinforcing at variable intervals did not seem to be effective, so keepers reevaluated the training plan and switched to reinforcing Pam every five seconds, and her tolerance for being touched for the necessary amount of time seemed to improve drastically. As with the touch behavior, veterinary staff continued to attend training sessions weekly to keep her accustomed to their presence.

Injection Training

The next behavior needed to be trained was thigh injection. The behavior was broken down into several steps, but all were built on the concepts of previously learned behaviors. First, the bird's wings were pulled forward to allow keepers access to their thighs. Next, trainers desensitized the birds to being poked in the thigh. This was done by first poking the birds with a finger, then a capped needle, and finally a blunt needle. Both birds responded well to all of the aforementioned steps, and were soon ready for an actual injection. Before injecting the birds with medication, veterinary staff chose to practice with a saline solution. Neither bird had a notable reaction to the injection. Since the behavior has been completed, both birds have been injected multiple times as part of their parasitology prevention plan with no adverse reaction.

Mirror Box Training

The final request that our veterinary staff made was to be able to check the bottoms of the birds' feet. Keepers brainstormed and decided that the safest way to do so would be to train the ostriches to step up on a mirror box. A mirror box is a box with a Plexiglas top and an angled mirror on the bottom. This allows a person standing next to the box to look down and see a reflection of the bottom of whatever is on the box. Keepers worked with the zoo's volunteer enrichment committee to design and construct a box that could support the weight of these large birds. The completed box was 26" x 38", made of wood and Plexiglas, and was able to support at least 350 pounds.

Once the box was constructed, keepers covered the Plexiglas with Window Wax, a waxy coating used to make the Plexiglas look solid, to help the birds realize they are stepping onto a solid surface. Keepers then began desensitizing the birds to the box by feeding them around it. The ostriches were then asked to walk towards the box. Once they lined up directly in front of it, they were asked to "Step up". Initially the ostriches attempted to walk around the box instead of stepping up. It was determined that placing the box approximately 6" from a wall or fence worked best for encouraging the birds to actually step on the box. Reinforcement was initially offered for standing directly in front of the box, then for placing one foot on the box, and ultimately for completely standing on the box. Keepers allowed the Window Wax to naturally wear off over time as the birds walked on the box. Once the majority of the window-wax had been removed, keepers completely cleaned the Plexiglas with no adverse reaction from the birds. The final part of the behavior was having someone approach the ostriches while they were on the box, and then squat down to check the bottoms of their feet using the mirror. Rose was immediately comfortable with being approached, but it took Pam several sessions to allow someone to approach her while she was on the box.

Conclusion and Future Work

Training for the set of behaviors needed for the annual exam took approximately two years. Rose is a fairly tractable bird and readily accepts almost all parts of the exam on a routine basis. Pam needs several practice sessions prior to the exam being conducted; however, she is becoming significantly more comfortable with the process. Pam's biggest challenge continues to be the length of the session. We have found she is most successful by breaking the exam up into smaller parts and completing it over several weeks.

Moving forward, keepers and veterinary staff have identified several other behaviors to be incorporated into their exam including: accepting eye drops, allowing neck palpitations, and visual checks of eyes, nares, and inside the mouth.

We have shown through a novel training method that ostriches can be trained to allow keepers and veterinary staff to perform body checks and accept injections and blood draws on their own accord. Our method uses positive reinforcement to achieve the desired behaviors and eliminates the need to immobilize or restrain the birds. This method helps build trust between the birds and staff, further allowing the birds to be worked in free contact. We have shown that our training method works not only with passive, keeper-oriented birds, but also with less compliant, more reserved birds. We are currently exploring using this training method with other ratites and related species.

Training Tales Editorial

by Angela Binney

Training Tales Column Co-Editor

Seeing this training initiative come to fruition is truly exciting! These techniques offer great potential for enhancement of female ostrich husbandry. I also enjoyed watching the YouTube video featuring Dan and Rose (Cincinnati Zoo, 2015). Dan also presented this work at the 2017 Animal Behavior Management Alliance conference, hosted by Cincinnati Zoo (Turoczi, 2017).

I'd love to see some discussion about potential applications of training with male ostrich. However, we should preface that topic with a word of caution for those not so familiar with male ostrich in breeding season. A training plan for male ostrich would require some detailed blue-sky type action planning with regard to safety, potential effects on overall disposition, and potentially designing facility modifications to accommodate protected contact management and training. Husbandry goals for a male may also include training them to easily shift into a holding area for safer access to exhibits, if this is not already routine. Depending on the individual circumstances, operant conditioning for close contact voluntary medical behaviors with a male may not be the best option for safety if the male is aggressive and managed with free contact. However, it is worth exploring from a hypothetical problem solving perspective to see if operant conditioning of any nature would benefit husbandry with male ostrich too!

The Cincinnati Zoo & Botanical Garden. 2015. Ever wonder how to train an ostrich. https://www.youtube.com/watch?v=EbeIrBKnwg8. June 24, 2015

Turoczi, D. 2017. Training 0.2 Ostrich for an Annual Exam. Animal Behavior Management Alliance Conference. Cincinnati, Ohio, April 24-28, 2017. p. 20.

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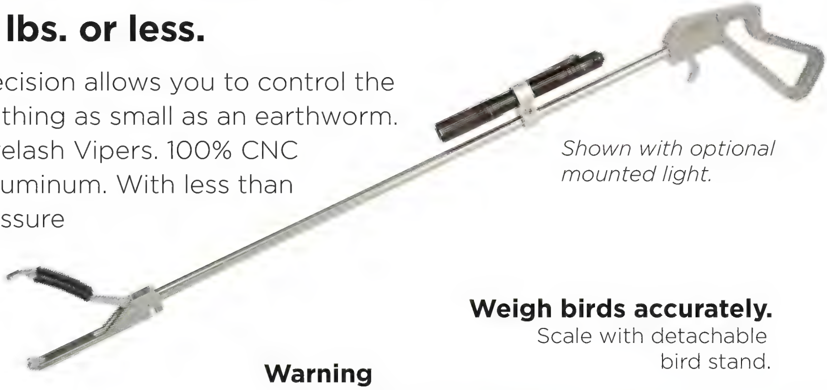

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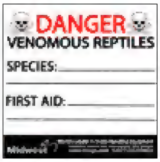

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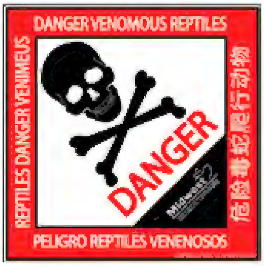

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Connecting Zoos Across the World

Kathryn Juliano
International Outreach Committee Member
AAZK

AAZK's International Outreach Committee (IOC) was founded in 2016 to explore and identify the professional development needs for the animal care community. Currently, the IOC focuses on providing resources, training opportunities, and continuing education to Latin American zoological institutions. The committee provides educational and mentorship resources and fosters connections between zoos in a variety of different ways.

Teaching Programs

One of the most impactful aspects of the IOC's work is the committee's Teaching Programs. These programs take place over three to four days at zoos in Latin America and provide continuing education for 80 to 100 animal caretakers. For each program, members of the IOC and keepers from zoos across

Attendees and presenters at the IOC Teaching Program in Durango, Mexico, take a group photo during the zoo day at Bioparque Sahuatoba.

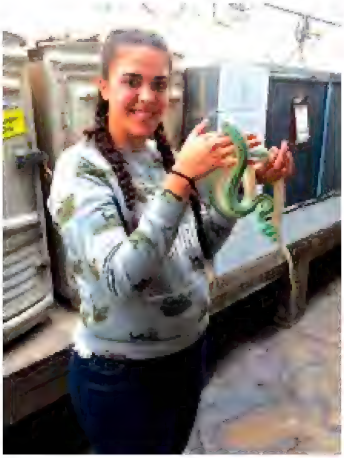
Yvette Kemp, the chair of the IOC, gives a presentation at the Teaching Program in Durango, Mexico.

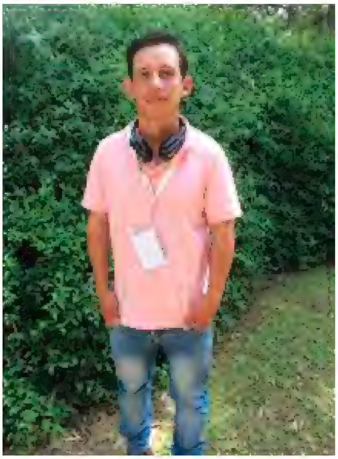
the United States travel to a facility in Latin America. The IOC and U.S. keepers present talks on a variety of different topics and host hands-on workshops. Latin American keepers also give presentations on various topics during the program. For some Latin American keepers, an AAZK Teaching Program is their first opportunity to attend or present in a continuing education setting. These programs often include poster sessions that provide attendees with another opportunity to discuss their work professionally. The teaching program also includes workshops and talks at the hosting institution's zoo during a "zoo day" where attendees are able to see discussed concepts in action.

The IOC has hosted three AAZK Teaching Programs in Mexico so far: in Guadalajara, Zacango, and Durango. The most recent Teaching Program in Durango took place between November 14 -17, 2018 and had 80 attendees from zoos throughout Mexico. IOC members and keepers from the San Diego Zoo presented on topics including venomous animal handling, large carnivore social management, operant conditioning training, animal ambassador programs, and working with dangerous animals. Mexican keepers presented on topics including environmental enrichment, operant conditioning with manatees, and the keeper's role in research. The program's zoo day at Bioparque Sahuatoba allowed attendees to implement environmental enrichment in various animal exhibits and watch the results. Each attendee left the program with a certificate of completion and a USB drive containing the presentations from the program as well as additional resources.

The teaching program also includes workshops and talks at the hosting institution's zoo during a "zoo day" where attendees are able to see discussed concepts in action.

The Durango AAZK Teaching Program also provided opportunities for the IOC to foster connections with other animal care professionals. The program overlapped with the annual conference of AZCARM (Association of Zoos, Aquariums, and Breeding Facilities of Mexico), which could be considered the Mexican equivalent of the AZA. IOC members and Teaching Program attendees mingled with AZCARM members and Durango government officials during an icebreaker, formal award gala, and an outing to a "Wild West" theme park. The Teaching program instructors were recognized for their service during the award ceremony and met the mayor of Durango and his wife. Members of the Mexican equivalent of AAZK, "Red





(Far left) Zazyl Mendez of the Guadalajara Zoo in Mexico was the first recipient of the AAZK conference scholarship and attended the 2017 conference in Washington, DC.

(Left) Ricardo Jiminez is a keeper at Parque Jaime Duque Zoo in Colombia who is sponsored by the Los Angeles AAZK Chapter as part of the International Keeper Sponsorship Program.

Photo 3: Attendees at the Teaching Program in Zacango, Mexico, make enrichment during a zoo day program.

Join the Team

The IOC is always looking for keepers, especially Spanish speakers, to help reach their vision to become a source of information for international animal care providers. If you are interested in participating as a presenter during an AAZK Teaching Program, helping to translate materials from English to Spanish, or helping your AAZK Chapter get involved in the International Keeper Sponsorship Program, please contact the IOC at ioc@aazk.org.

de Cuidadores", also attended the Teaching Program and presented about their association. The IOC's AAZK Teaching Programs help the committee create and foster connections within the zookeeping community and ensure that the IOC is a source of information and mentorship for international animal care providers.

Grants and Sponsorships

The IOC has additional initiatives to help reach their mission of providing resources and training opportunities to the Latin American zoological community. The committee has a scholarship program to help Latin American keepers attend the AAZK National Conference. The scholarship provides keepers with $2,000 to use towards travel expenses and registration costs. The IOC AAZK also offers an International Keeper Sponsorship Program that allows AAZK Chapters to cover the AAZK membership costs for a Latin American keeper for one year. The Sponsorship Program started last year with 10 participating AAZK Chapters. One keeper that received an AAZK membership stated that the program allows him to increase his knowledge about animal training, behavior, and enrichment.

Resources and Translations

The IOC also helps increase the number of resources available to Latin American keepers by translating a variety of materials. The committee translates AAZK conference proceedings from English to Spanish as well as AAZK's social media posts. The committee stores translated resources and presentations from Teaching Programs in an online database. The IOC also works with different organizations including ALPZA (Latin American Zoo and Aquarium Association) and the ICZ (International Conference of Zookeepers) to translate various materials. The IOC helped the ICZ by translating abstracts, posters, and presentations for the first bilingual ICZ conference in Buenos Aires, Argentina, in October of 2018.

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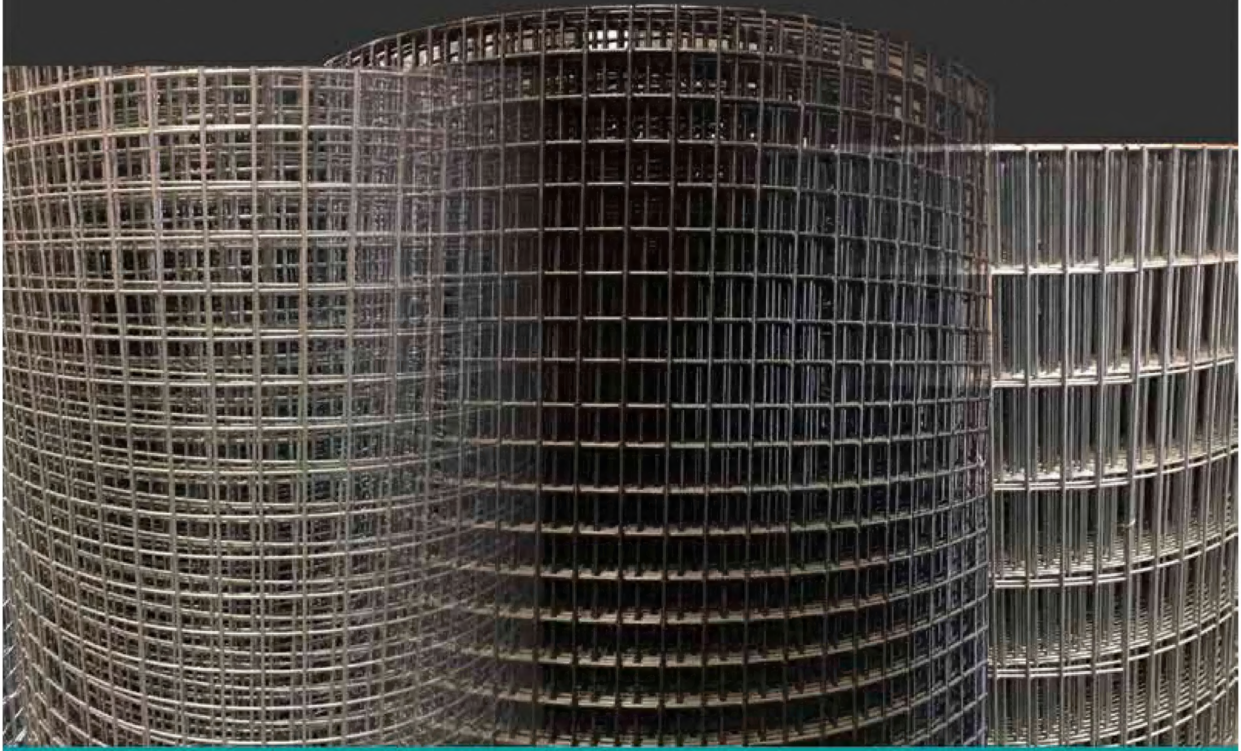

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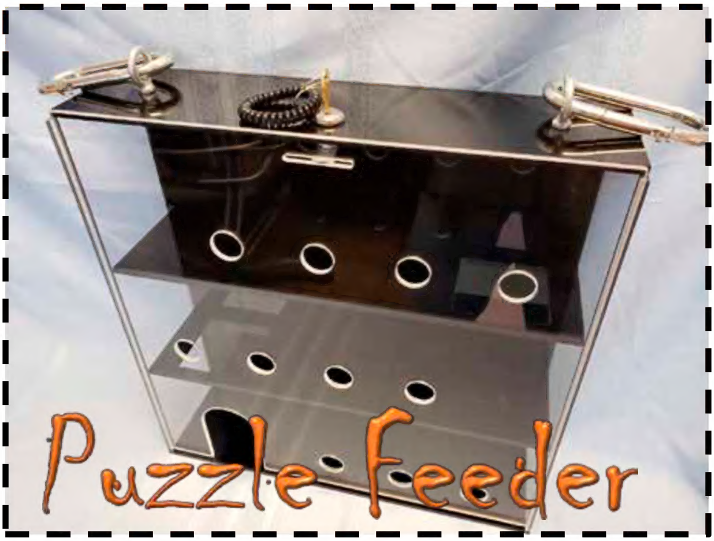

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